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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/601,540	09/06/2000	David Tomanek	6550-000017	4174

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EXAMINER	
BRITTAIN, JAMES R	

ART UNIT	PAPER NUMBER
3677	

DATE MAILED: 05/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/601,540	TOMANEK ET AL.	
	Examiner	Art Unit	
	James R. Brittain	3677	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 August 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,24-29,35,36,39-42,44-51,57,58,61-65 and 67-80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *24-29,35,36,39-42,44-51,57,58 and 61-65* is/are allowed.

6)☒ Claim(s) *1 and 67-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *21*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 75 and 76 are objected to because of the following informalities: Claim 75 indicates that there is "a plurality of functionalized non-linear nanotubes" extending from the substrate. However, claim 73 from which this claim depends has narrowed the non-linear nanotube to a group of shapes. It is not clear if the same non-linear nanotubes are being described, but it is assumed that applicant is describing the non-linear nanotubes of claim 73. The term "the first and second fastening elements" (claim 76, line 2) lacks clear antecedent basis because claim 74 does not number the fastening elements. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 74 and 76-80 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 74 defines the microfastening system as being plurality a plurality of mating nanoscale fastening elements, wherein the fastening elements comprise carbon nanotubes structurally modified to include bent portions. The nanotubes are so disposed so as to become mechanically interconnected as the elements are advanced toward one another. The scope of this claim includes a mass of entangled fastening elements or simply two fastening elements each

fastening element comprising a single nanotube with bent portions that are mechanically interconnected with each other. Applicant has no disclosure to support a claim of such broad scope. Applicant's sole disclosure is to each fastening element including a plurality of extending nanotubes. Claim 76 also contains new matter because applicant has no disclosure for having some fastening elements comprise a substrate from which the nanotubes extend and other fastening elements each comprising a single nanotube with bent portions that can become entangle with each other and the nanotubes extending from the substrate. Claims 77-80 contain new matter through their dependence from claims that incorporate new matter.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. §102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

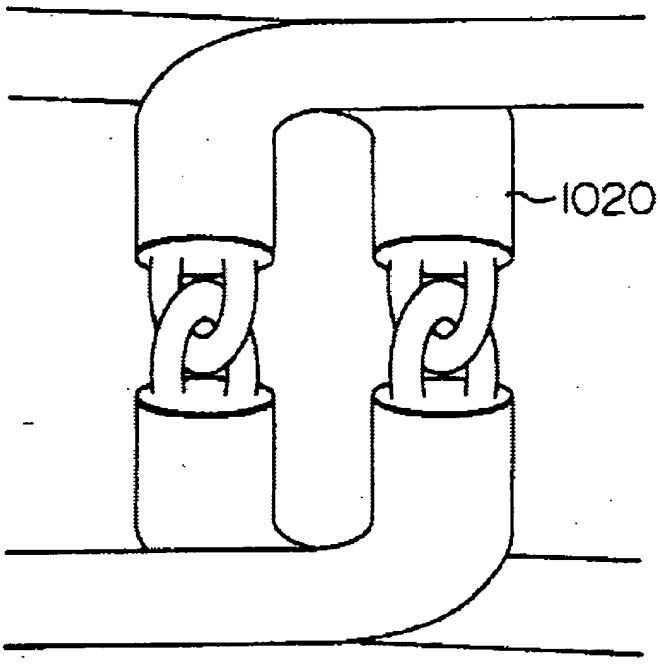
The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 67-69, 72-76, 79 and 80 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Ihara et al. (US 5464987).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two nanotubes, each comprising a half torus, secured to a lower substrate

comprising the two surfaces facing upward interengaging with a second fastening element comprising two nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The middle portion of figure 10 is reproduced below.



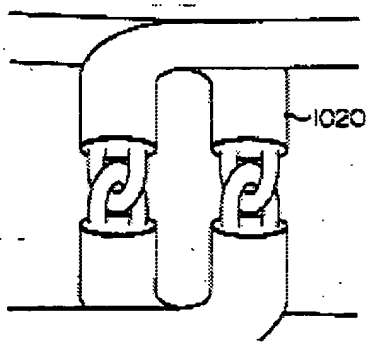
The nanotubes are mechanically interconnected as shown in the above figure. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. As to claim 67,

the toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized and further the curved and therefore nonlinear nanotubes have one end defined by the two open ends of each half-torus that is joined to the substrate and an intermediate end distal the substrate that is free of the surface of the substrate.

In regard to claim 68, Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. As to claim 69, the substrates are indicated above as being in figure 10, the two surfaces facing upward comprising the lower substrate and the two surfaces facing downward comprising the upper substrate. In regard to claim 72, the nanotubes

form half-tori and are therefore a non-linear shape. As to claim 73, the structure of the half-tori explicitly meets the loop shape. In regard to claim 75, the toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized and further the curved and therefore nonlinear nanotubes have one end defined by the two open ends of each half-torus that is joined to the substrate and an intermediate end distal the substrate that is free of the surface of the substrate.

In regard to claim 74, Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising a functionalized nanotube comprising a half torus interengaging with a second fastening element comprising a functionalized nanotube comprising a half torus. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized by having this structural modification from the hexagon in localized areas. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the half-tori are joined by advancing toward each other. While this bringing together of the two components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. The middle portion of figure 10 is reproduced below.



As to claim 76, Ihara et al. also suggests attaching the open ends of the half-torus nanotubes to substrates as shown in figure 10, the two surfaces facing upward comprising the lower substrate and the two surfaces facing downward comprising the upper substrate. In regard to claim 79, the nanotubes form half-tori and are therefore functionalized to a non-linear shape. As to claim 80, the structure of the half-tori attached to the substrate explicitly meets the loop shape.

Claims 70 and 77 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ihara et al. (US 5464987).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the

teachings of Ihara et al. The difference is that Ihara et al. doesn't explicitly teach what the material of the substrate comprises for the mechanical connection of figure 10. However, it is taught that silicon is a material to which the molecules can be adsorbed (col. 5, lines 26-29). It would have been obvious to recognize from the teaching of Ihara et al. that silicon is a material to which the half-torus molecules can be adsorbed and therefore utilize it for the substrate.

Claims 71 and 78 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ihara et al. (US 5464987) in view of Yakobson et al. (*Fullerene Nanotubes: $C_{1,000,000}$ and Beyond*).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. The difference is that Ihara et al. doesn't utilize multi-walled nanotubes.

However, Yakobson et al. (figure 2) suggests that multi-walled nanotubes are well known and from elementary mechanics it is well understood that multiple walls are stronger than single walled structures. As it would be beneficial to make the mechanical connection of Ihara et al. stronger, it would have been obvious to modify the nano-scale mechanical connection of Ihara et al. so that the half-tori are multi-walled in view of Yakobson et al. providing evidence of such structures as being well known and their use would be desirable for their inherently greater strength over single-walled structures, thereby providing a stronger mechanical connection.

Allowable Subject Matter

Claims 24-29, 35, 36, 39-42, 44-51, 57, 58 and 61-65 are allowed.

Response to Arguments

Applicant's arguments filed January 10, 2003 have been fully considered but they are not persuasive.

Applicant argues the limitation indicating that the nanotubes are disposed so as to become mechanically interconnected as they advance toward one another is a structural limitation that distinguishes over Ihara et al. This argument is advanced for independent claims 1, 68 and 74. The argument is unpersuasive because Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the

obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. Having the elements of the micro-fastener disposed so that the half-torus nanotubes become mechanically interconnected must be accomplished by the nanotubes advancing toward one another. Applicant also indicates that a point of distinction is that the device of Ihara et al. has two ends of the nanotube attached to the substrate. However, in view of the claimed subject matter this has been addressed before by pointing out with respect to claims 67 and 75 that Ihara et al. teaches the curved and therefore nonlinear nanotubes having one end defined by the two open ends of each half-torus that is joined to the substrate and having an intermediate end distal the substrate that is free of the surface of the substrate.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James R. Brittain whose telephone number is 703-308-2222. The examiner can normally be reached on M, W & F 5:30-1:30, T 5:30-2:00 & TH 5:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, J. J. Swann can be reached on 703-306-4115. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

James R. Brittain
Primary Examiner
Art Unit 3677

JRB